Vacuum Technology

Vacuum Process Engineering

Measuring and Analytical Technology

LEYBOLD

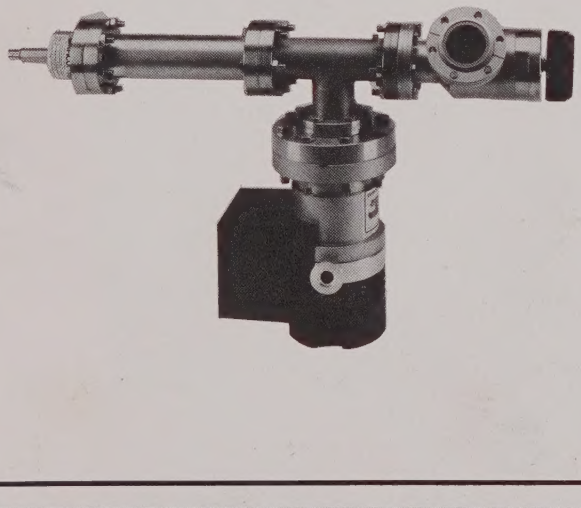
LEYBOLD INFICON INC.

Part Number 074-060

IPC-2

Pressure Converter

MANUAL



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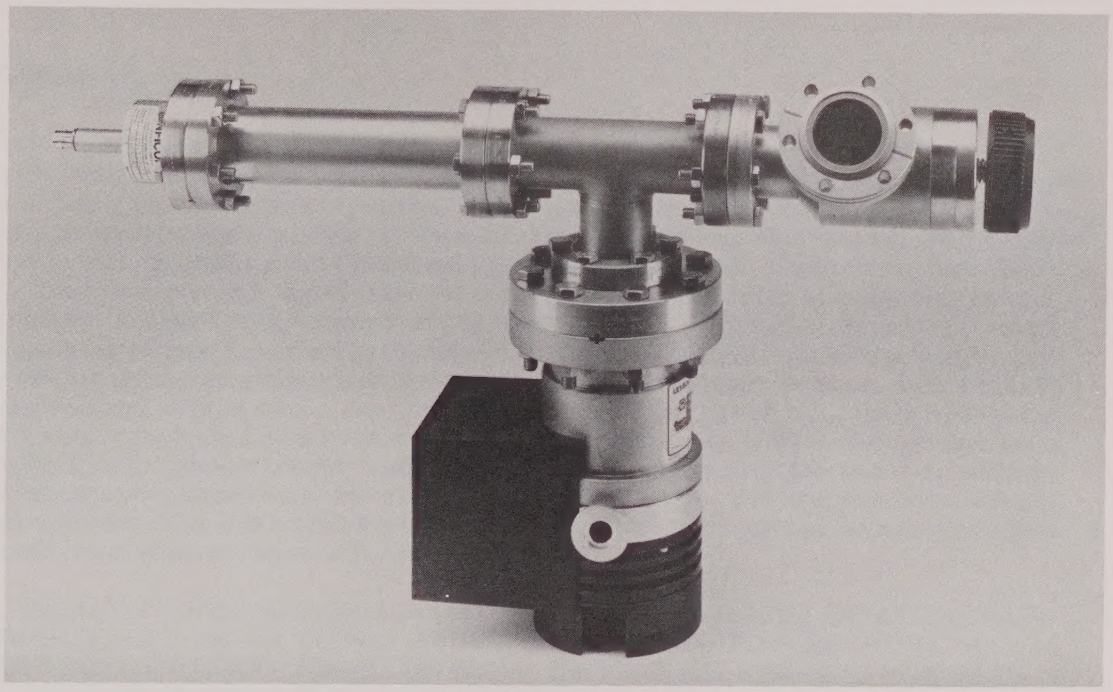
THE IPC-2 PRESSURE CONVERTER



The IPC-2 is a low-cost pressure converter for the Quadrex family of gas analyzers and partial pressure controllers that extends the sampling pressure range of the quadrupole's sensors from 10^{-4} to 10 torr. This means you can monitor and control your vacuum system at base pressure, during gas backfill, and throughout your plasma process--regardless of whether yours is a sputtering, etching, or deposition process.

The IPC-2 is a two-stage, single valve design because a single valve is easier to use, more cost effective, and more compact. This unique valve (patent pending) has one knob with three positions--orifice sampling with positive locking detent, high vacuum sampling, and closed. For applications that always exceed 10^{-4} torr, the IPC-2 is easily converted to a two position device that prevents opening the valve to the high vacuum sampling position.

The valve is Viton® sealed and bakeable to 190°C.

The IPC-2's precision stainless steel orifices are reusable and easily interchangeable. They are available in millitorr, 1 millitorr, 10 millitorr, 150 millitorr, 1 torr and 10 torr, so you can select on specifically designed sample your particular process.

The IPC-2 is available with a turbomolecular pump system. This system can be used with any of the Quadrex or QX 2000 quadrupole residual gas analyzers.

WARRANTY

WARRANTY AND LIABILITY - LIMITATION: Seller warrants the products manufactured by it, or by an affiliated company and sold by it, and described on the reverse hereof, to be, for the period of warranty coverage specified below, free from defects of materials or workmanship under normal proper use and service. The period of warranty coverage is specified for the respective products in the respective Seller instruction manuals for those products but shall in no event exceed two (2) years from the date of shipment thereof by Seller. Seller's liability under this warranty is limited to such of the above products or parts thereof as are returned, transportation prepaid, to Seller's plant, not later than thirty (30) days after the expiration of the period of warranty coverage in respect thereof and are found by Seller's examination to have failed to function properly because of defective workmanship or materials and not because of improper installation or misuse and is limited to, at Seller's election, either (a) repairing and returning the product or part thereof, or (b) furnishing a replacement product or part thereof, transportation prepaid by Seller in either case. In the event Buyer discovers or learns that a product does not conform to warranty, Buyer shall immediately notify Seller in writing of such non-conformity, specifying in reasonable detail the nature of such non-conformity. If Seller is not provided with such written notification, Seller shall not be liable for any further damages which could have been avoided if Seller had been provided with immediate written notification.

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This manual is intended for private use by Leybold Inficon Inc. and its customers. Contact Inficon before reproducing its contents.

Note: These instructions do not provide for every contingency that may arise in connection with the installation, operation or maintenance of this equipment. Should you require further assistance, please contact Leybold Inficon Inc.

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LEYBOLD INFICON

REGISTRATION CARD

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1. In what type of process is the instrument used? _____

2. Did you find errors in the manual? Please cite pages where this occurred.

3. Did you find instructions hard to follow or descriptions difficult to understand? Please cite specific references.

4. Were there areas not covered in the manual that would have been helpful if included? Please cite what these areas would be.

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PREFACE

This manual covers the installation, operation, and maintenance of the IPC-2 Pressure Converter. A general outline of the format and contents of this manual follows.

IPC-2 Specifications
Description
Table of Contents
Illustrations and Diagrams Listing
Inspection and Inventory
Installation
Replacing the Orifice
Operation
Theory of Operation
Maintenance
Heating Jacket Instructions
Schematics

When using this manual, please pay particular attention to NOTES, CAUTIONS, and WARNINGS found through the text. For our purposes they are defined as follows:

NOTES: Pertinent information useful in achieving maximum instrument efficiency when followed.

CAUTION: *Failure to heed these messages could result in damage to your instrument.*

WARNING!!
THE MOST IMPORTANT MESSAGES. FAILURE TO HEED COULD RESULT IN PERSONAL INJURY AND/OR SERIOUS DAMAGE TO YOUR INSTRUMENT.

We invite you to comment on the usefulness and accuracy of this manual by filling out the reply card and returning it to us.

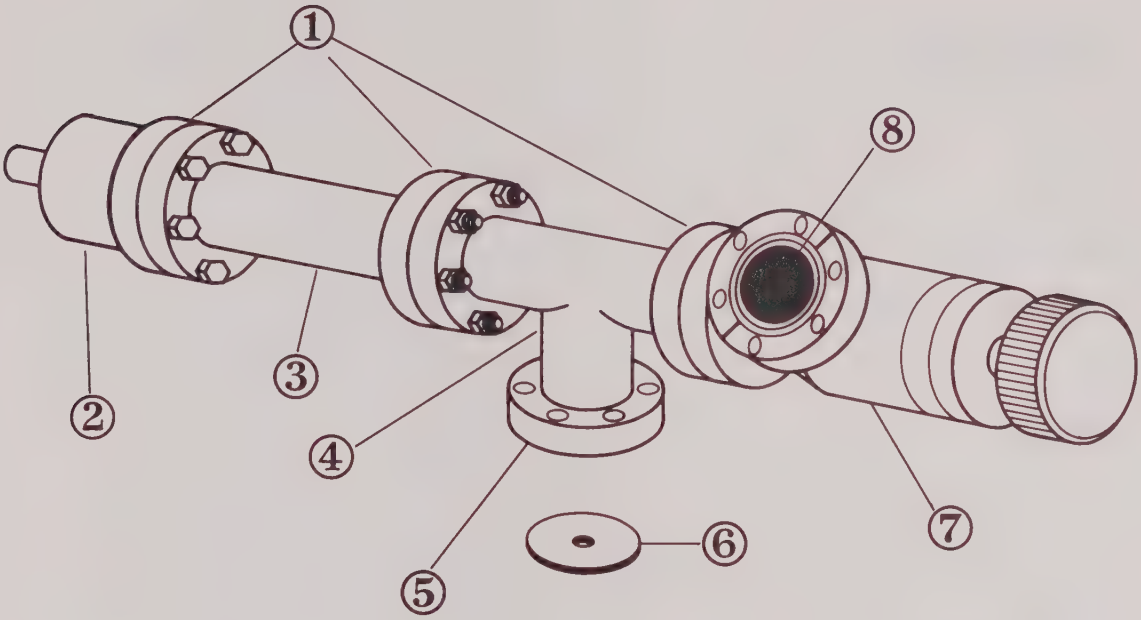
WARNING!!
WHEN USING THIS SYSTEM FOR GAS SAMPLING OF *CORROSIVE* OR *HAZARDOUS* GASES, ADDITIONAL PRECAUTIONS MUST BE TAKEN. PLEASE CONSULT THE APPROPRIATE PUMP MANUAL FOR NECESSARY PRECAUTIONS.

NOTE: The IPC-2 and pumping package configurations covered by this manual are:

IPC-2 without pumps (user supplies the high vacuum pumping)
IPC-2 with 50 liter per second turbomolecular pump.
IPC-2 with 150 liter per second turbomolecular pump.
IPC-2 with 150 liter per second turbomolecular pump and purge valve for some corrosive applications.

IPC-2 SPECIFICATIONS

Base Pressure:	$1x10^{-8}$ torr
Maximum Operating Pressure:	Dependent on customer selected orifice. Sizes from .1 millitorr to 10 torr are available.
Orifices:	Precision stainless steel orifices, reusable and interchangeable. Available in .1 millitorr, 1 millitorr, 10 millitorr, 150 millitorr, 1 torr, and 10 torr.
Turbo Pump Package:	Turbo Pump--50 liter/second capacity, air cooled Weight--4 lbs. (1.8 kg.) Turbo Pump Controller--120 VAC, 60 Hz, 45 watts max. Weight--4 lbs. (1.8 kg.) Interconnect cable from controller to pump--10 ft. (3.0 m) Mechanical Pump--1.1 CFM 120 VAC, 60 Hz, 7 amp max. (1.6 HP), single phase. Weight--19 lbs. (7 kg.) Venting Device--120 VAC 3 to 5 psig. gas inlet pressure
Turbo Pump Package:	Turbo Pump--150 liter/second capacity, water cooled (air cooling optional) Weight--15.4 lbs. (7.0 kg.) Turbo Pump Controller--120 VAC, 60 Hz Weight--18.7 lbs. (8.5 kg.) Interconnect cable from controller to pump--10 ft. (3.0 m) Mechanical Pump--D4B--3.4 CFM 120 VAC, 60 Hz, 1/3 HP, single phase. Weight--51 lbs. (23 kg.)
Corrosive Pumping Package:	Mechanical Pump--D8B--6.9 CFM, 120 VAC, 60 Ha, 3/4 HP, single phase Weight--65 lbs. (30 kg.)
Mating Flange:	2¾" ConFlat®
Valve Type:	Manual Valve - 1" bellows sealed, Viton® gaskets bakeable to 190°C Electropneumatic valve - 1" bellows sealed, Viton gaskets bakeable to 190°C, 120VAC, air pressure--50 lbs. to 125 lbs. psig.
Shipping Weight:	Turbo Pump System--50 l/s pump--55 lbs. (25 kg.) Turbo Pump System--150 l/s pump--125 lbs. (57 kg.)
Heating Jackets:	Heating jacket assembly--fitted design, insulated, switchable thermostat between 190°C and 100°C. Three piece assembly for IPC-2 manifold, connecting tee and quadrupole head. Available in Faraday Cup and Electron Multiplier versions. High Flow Option is available for Quadrex PPC users. Contact Leybold Inficon Inc. for more information.



1.	FLANGES	These ConFlat® compatible flanges are 2" O.D. UHV. They are identical mating (no male or female) and leak tight when properly installed.
2.	FARADAY CUP SENSOR	Electron multiplier sensor may be substituted in place of this sensor.
3.	FARADAY CUP ADAPTER	Standard nipple configuration. UHV quality. Electron multiplier nipple may be substituted in place of the standard nipple.
4.	SENSOR HOUSING	Connects IPC-2, sensor pump.
5.	PUMPING PORT	The standard ConFlat flange allows this port to be mated to the Inficon turbo pump.
6.	RESTRICTOR GASKET	This high quality gasket regulates the pumping speed to insure that the sensor region gases accurately reflect the composition of the sample inlet gases.
7.	TWO STAGE VALVE	Single, two-stage valve with three positions: orifice sampling with positive locking detent, high vacuum sampling, and closed.
8.	SAMPLE INLET	Conveniently connected via rotatable ConFlat flange to your process chamber or vessel.

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INSPECTION AND INVENTORY

As soon as possible after you receive the IPC-2, unpack the shipping containers and check for any visible damage. Please notify the carrier and Inficon immediately if you find any damage.

Check your items against the list provided below:

The IPC-2 assembly carton contains the following:

Quantity		Part #
IPC-2 Pressure Converter (with orifice installed), 8 lbs. (3.6 kg)		
	Manual Valve Model, or	900-002-G1
	Electropneumatic Valve Model	900-002-G2

Installation Parts Kit containing:

(2)	Copper Gaskets for 2.75" ConFlat Flange	012-328
(1)	Pump Restrictor Gasket	012-318
(18)	- 28 x 1 S.S. Flange bolts	096-001
(18)	- 28 S.S. Nuts	096-003
(1)	IPC-2 Pressure Converter Manual	074-060

If you ordered a complete IPC-2 system including pumping equipment, you should also have received two or more additional boxes containing one of the following:

A.	(1)	TMP 50 Turbomolecular Pump* (Leybold) 4 lbs. (1.8 kg)	012-520
	(1)	NT 50 Frequency Converter* (Leybold) 4 lbs. (1.8 kg)	012-521
	(1)	4" - 2" Adapter Flange	015-532
	(1)	Venting Device Assembly	012-522
	(1)	Installation Parts Kit for Turbo, Containing:	
		(6) - 28 x 7/8 S.S. Bolts	096-004
		(8) 5/16 - 24 x 2 S.S. Bolts	097-001
		(8) 5/16 - 24 S.S. Nuts	097-002
		(1) Turbo Pump Instruction Manual	074-003
	(1)	D1.6B Pump, Rotary Vane* (Leybold) 19 lbs. (8.7 kg)	012-531
	(1)	SE 2/4 Smoke Eliminator (Leybold)	012-378
	(1)	Elbow, KF16	015-548
	(1)	Hose Assembly, PVC, KF16	012-524
	(2)	Centering Ring & Seal, KF16	015-521
	(2)	Clamp KF10/16	015-522

OR

B. (1) TMP 150 Turbomolecular Pump* (Leybold) 4 lbs. (1.8 kg) LH85612
(1) NT 50 Frequency Converter* (Leybold) 4 lbs. (1.8 kg) LH85472-3
(1) 6" - 2" Adapter Flange 050-030
(1) Venting Device Assembly 012-522
(1) Installation Parts Kit for Turbo, Containing:
'6) - 28 x 7/8 S.S. Bolts 096-004
(16) 5/16 - 24 x 2 S.S. Bolts 097-001
(16) 5/16 - 24 S.S. Nuts 097-002
(1) Turbo Pump Instruction Manual 074-003
(1) D4B Pump, Rotary Vane* (Leybold) LH91245-1
(1) SE 2/4 Smoke Eliminator (Leybold) 012-378
(1) Elbow, KF25 012-374
(1) Hose Assembly, PVC, KF25 012-359
(2) Centering Ring & Seal, KF25 012-375
(2) Clamp KF25/16 012-376
(1) Reducer, KF25/16 012-377
(1) RST Trap 015-502

OR

C. If the corrosive pumping package was ordered a larger mechanical pump will be substituted for the D4B mechanical pump, a purge valve will be included, and an AF Exhaust Filter will be substituted for the smoke eliminator.

(1) D8B Pump, Rotary Vane* LH91255-1
(1) AF-8 Exhaust Filter LH18906
(1) Metering/Vent Valve; N_2 Purge LH85518

Optional Air Cooler for Turbomolecular Pump

(1) Air Cooler Kit LH89407

D. If the heating jacket assembly was ordered, the following will also be included:

(1) Heating Jacket for IPC-2 Faraday Cup System 8 lbs. (3.6 kg) 900-003-G1
(1) Heating Jacket for IPC-2 Electron Multiplier System 8 lbs. (3.6 kg) 900-003-G2

*Includes operating instructions

INSTALLATION

> **NOTE:** Three exploded assembly drawings have been included to assist you in installing the IPC-2. They are located at the back of this manual.

The IPC-2 is shipped partially assembled to simplify installation. Refer to Figures 1 and 2 for possible location and orientation of the IPC-2, following the instructions below:

> ***CAUTION:*** *Use ultra-high vacuum techniques when installing the IPC-2. Avoid contaminating vacuum surfaces with dust, grease, fingerprints or other foreign materials.*

1. Attach the IPC-2 Pressure Converter valve assembly to the vacuum system which is to be monitored by the Inficon quadrupole. This requires a 2.75" O.D. ConFlat flange on your system. Use the six bolts and nuts already installed in the system mating flange of the IPC-2, after first placing one of the (supplied) copper gaskets between the flanges.

   The ConFlat flange sealing system used in the IPC-2 makes highly reliable vacuum connections. For good results with this system, however, use the following recommendations.

   a. Make sure copper gaskets and sealing surfaces are clean and free from contaminants.

   b. *DO NOT* reuse copper gaskets.

   c. Lubricate the bolt threads with an anti-seize compound (such as Fel-Pro® C-100) especially if bake-out will be required.

   d. Align the flanges properly so that the gasket fits into the recesses in both flanges and they are parallel.

   e. Tighten bolts gradually and evenly, in a crisscross pattern, until flange faces come into contact.

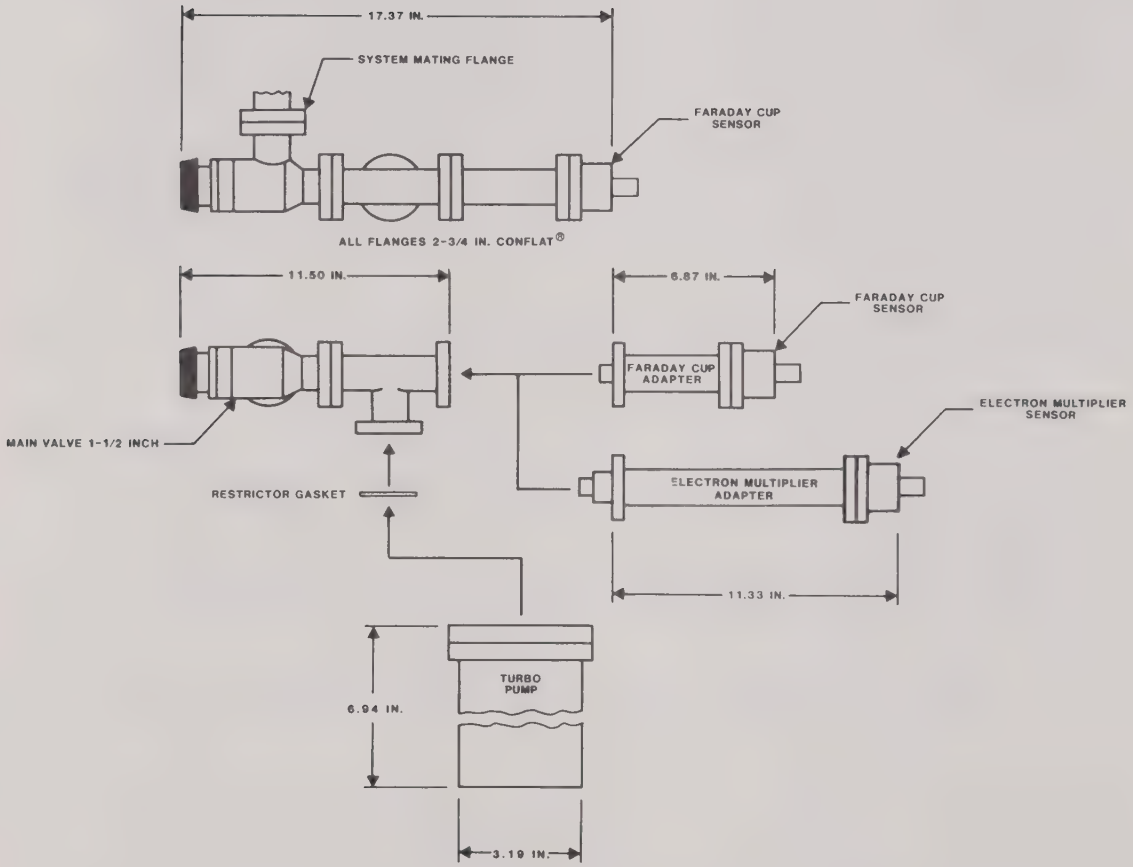

Figure 1 - IPC-2 Pressure Converter Pump Configuration

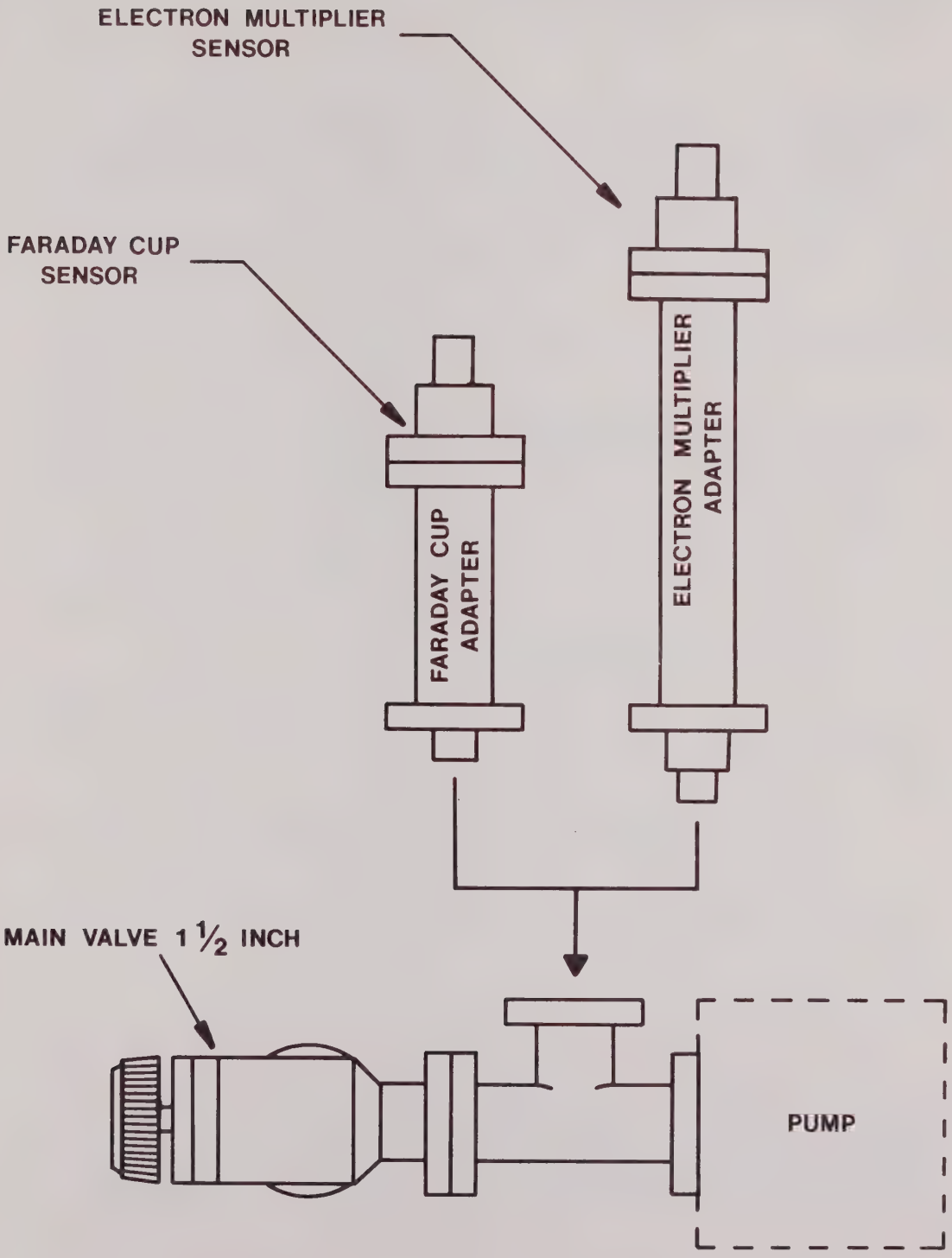

Figure 2 - Alternate Mounting Arrangement

2. The turbo pump system is assembled as follows: (Review the Turbovac® Manual before installation)

   a. Using the large copper gasket with the turbo pump, attach the adapter flange to the inlet of the turbo pump. The 5/16 - 24 x 2" screws and nuts in the turbo installation parts kit are for this purpose. Follow ConFlat flange instructions given on page 2.

NOTE:	The air cooler for the TMP-50 turbo pump is factory installed. No additional installation for the air cooler is necessary.

   The air cooler for the TMP-150V turbo pump is optional. It must be installed on the pump. Please refer to the turbo pump instruction manual for installation instructions.

   b. Connect the turbo pump to the IPC-2 assembly using the six - 28 x 7/8" screws supplied with the turbo pump. Insert the pump restrictor gasket between the flange of the IPC-2 assembly and the adapter flange on the turbo pump. The turbo pump may be mounted in any position and should be oriented for optimum ease of connection of the power cable and backing pump vacuum line and venting device assembly. Tighten according to ConFlat flange instructions.

CAUTION:	*It is important to support the weight of the turbo pump to avoid excessive stress on the flanges and weld joints of the IPC-2 or the vacuum system.*

   c. The inert gas venting device assembly is attached to the turbo pump (the top port) outlet by means of the KF clamp and seal supplied with the pump. (See Figure 3)

   Attach a low pressure (3 to 5 psig) supply of dry inert or noble gas such as nitrogen or argon to the inlet (1/8" NPT) of the solenoid valve of the venting device assembly. Connect the solenoid valve power cord to a convenient 110/120 VAC outlet.

NOTE:	The venting device used is a "normally open" vent valve. Power must be applied to the vent valve to close it and must be done before the turbo pump is turned on. When the power is lost, the vent valve will automatically open and cause the high vacuum system to vent.

   d. A suitable backing pump must be connected to the exhaust port of the turbo pump (this is the bottom KF port). The backing system must provide a lower pressure (p <50 mtorr) at the turbo pump discharge when the turbo pump is running.

   e. If the corrosive pumping package was purchased, the N_2 must then be attached to the purge valve. Consult the turbo pump manual for more information.

WARNING!!

IT IS ESSENTIAL THAT THE PURGE/VENT VALVE IS CONNECTED TO A SOURCE OF INERT GAS OR SEALED WHEN PUMPING TOXIC OR REACTIVE PROCESS GAS. THE PURGE/VENT VALVE ISN'T A SHUTOFF DEVICE. IF ITS INLET PORT IS LEFT OPEN, TOXIC PROCESS GAS COULD ESCAPE AFTER SHUTDOWN OR AIR COULD ENTER THE PUMP AND HAVE A DANGEROUS REACTION WITH AGGRESSIVE PROCESS GAS.

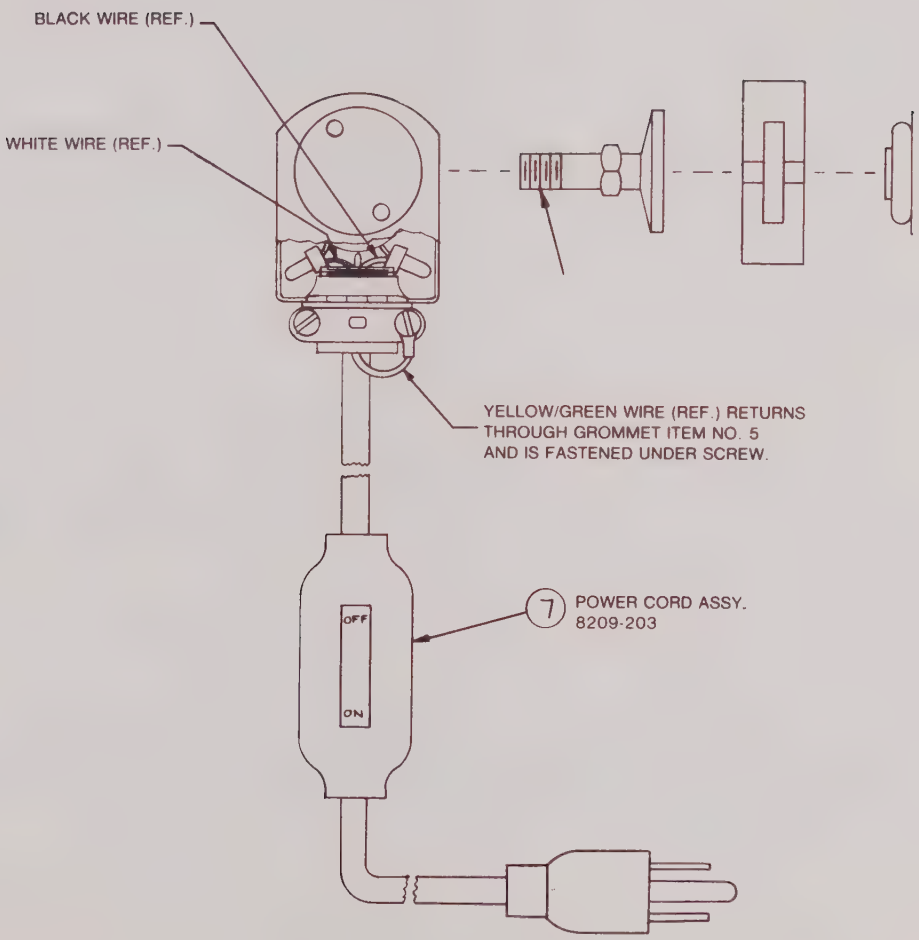

Figure 3 - Venting Device Assembly

f. If the backing pump kit is ordered, install it as follows: Connect the PVC hose assembly to the exhaust port of the turbo pump (this is the bottom KF port). Connect the inlet of the rotary vane pump using the other end of the PVC hose assembly. A KF elbow is included for use if needed to improve the routing of the hose.

Attach the smoke eliminator to the discharge connection flange of the pump.

If the corrosive pumping package is purchased, attach the AF exhaust filter to the discharge connection flange of the pump.

Connect the rotary vane pump power cord to a 110/120 VAC 60 Hz outlet. Review the rotary vane pump instruction manual before operating. Install the supplied oil into the pump. The recommended replacement oil for this pump is HE-200, available from Leybold Vacuum Products.

CAUTION: *The mechanical pump is not shipped with oil in it. The oil must be installed before running the pump to prevent pump damage.*

CAUTION: *When installing the backing pump and associated accessories do not put additional mechanical stress on the turbo pump and the IPC-2 assembly.*

NOTE: In the event of a power failure, the turbo pump does NOT restart automatically, whereas the backing pump will immediately resume operation after restoration of power which could result in oil vapor backstreaming into the turbo pump, the IPC-2, and the Inficon quadrupole sensor. For automatic starting after resumption of power, a jumper must be added to the terminal block on the rear of the NT frequency converter. Review the operating manual for the NT 50 or NT 150.

If the system is to run unattended, install provisions for automatic restart.

For additional protection against oil vapor backstreaming, attach a molecular sieve trap to the foreline of the backing pump.

3. Install the Inficon quadrupole sensor in the IPC-2 assembly using the remaining six bolts and 2" copper gasket as shown in Figure 2. Apply thread lubricant and tighten bolts according to the ConFlat flange instructions. Orient the sensor in a position that best facilitates attachment of the interconnecting cables to the Inficon quadrupole control unit and RF unit.

> ***CAUTION:*** *Be very careful when inserting the sensor into the IPC-2 assembly to avoid damaging the ion source structure on the tip of the sensor.*

4. If the IPC-2 is supplied with electropneumatic valves, connect the air supply to both control solenoids and observe the following precautions:

   a. Do not exceed 190°C temperature (of the IPC-2) or the valve actuating mechanisms may be damaged.

   b. Minimum air pressure should not be less than 50 psig. Do not exceed 125 psig air pressure or actuators will be damaged.

   c. Wire the control solenoids to a source of line voltage (120 VAC) as illustrated in Figure 4.

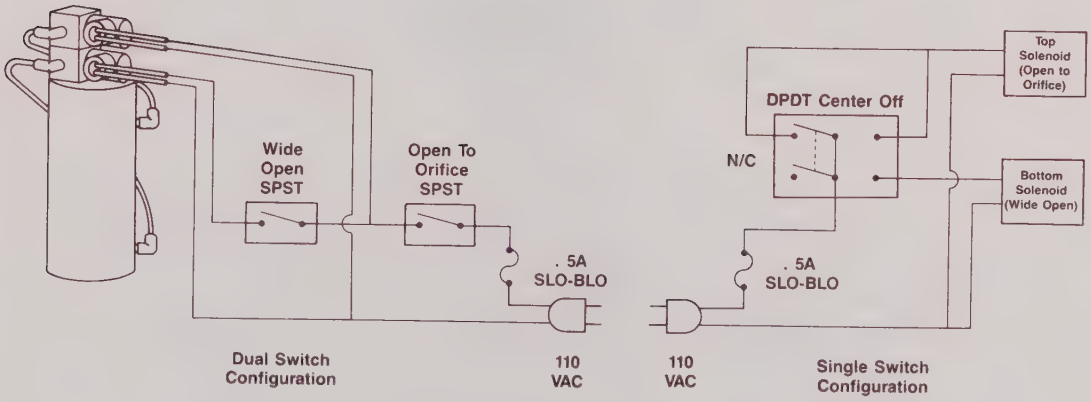

Figure 4 - Solenoid Wiring Diagram

REPLACING THE ORIFICE

Manual Valve Instructions

The entire vacuum system must be at atmosphere to replace the orifice. It is not necessary to remove the outer valve body from the system. However,

1. Open the valve to the fully open position by pulling the spring loaded detent and opening the valve completely.

2. Using a 5/32 right angle Allen wrench, remove the 6 screws that fasten the valve bonnet to the outer valve body.

3. Grasping the valve body space with the valve bonnet, take the inner valve assembly from within the valve body (Figure 5).

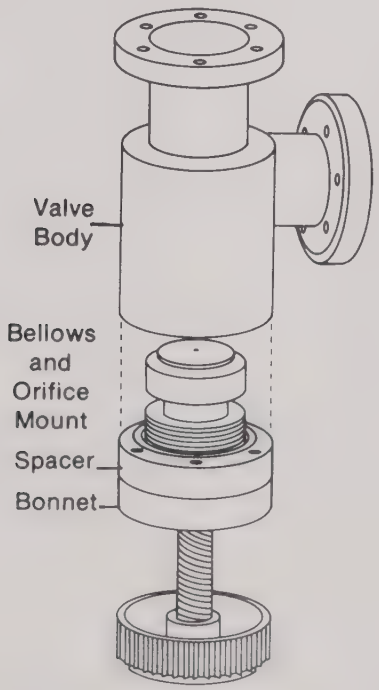

Figure 5 - Manual Valve Assembly Removed

CAUTION: *Use clean, lint-free gloves and tweezers to avoid system contamination. Avoid rubber gloves as they may cause talcum contamination.*

4. Hold the bellows laterally. Gently push and rotate the orifice mount 1/4 turn to remove it (Figure 6).

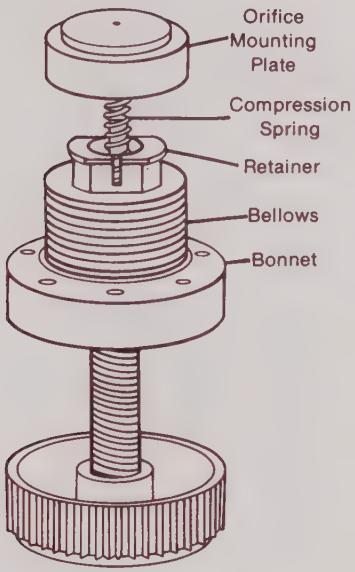

Figure 6 - Orifice Mount Removed

5. Set the inner valve assembly and spring aside on a clean surface.

6. Remove the top Viton® seal from the orifice plate. If the orifice plate sticks to the bottom Viton seal, use a soft, blunt rod (tightly rolled piece of paper will do) to free the plate from beneath.

NOTE:	Orifices may be reused if they are stored away from contaminants. DO NOT attempt to use an orifice which has become bent or deformed in handling, as it will not seal properly.

7. New orifice sets are shipped with both seals included. Place the bottom seal in the insert and center it before the orifice plate is installed, followed by the top seal and the washer (see Figure 7).

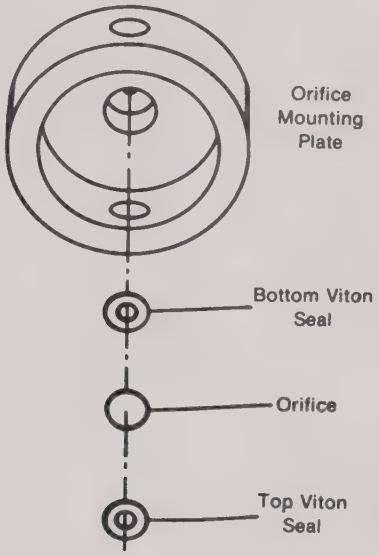

Figure 7 - Seal Installation

8. With the main spring on the plunger of the inner valve assembly, insert the retainer laterally into the orifice mount, so that the fins on the retainer clear the pins and the spring is seated on the seal. Push in the spring and rotate the mount 1/4 turn, aligning the slot in the retainer with the hole in the mount.

Electropneumatic Valve Instructions

The entire vacuum system must be at atmosphere. It is not necessary to remove the outer valve from the system. You may wish to disconnect the air and power lines to the solenoid valves; in any event, make sure the power is off before disassembling the valve. You must either disconnect the air and power lines from the solenoids or remove the solenoid manifold assembly, with its air lines, from the cylinder.

1. Support the cylinder and push it (with over 35 lbs. of force) towards the valve body while removing the three screws fastening the bottom of the cylinder support to the valve body.

2. While supporting the air cylinder assembly, unscrew the entire assembly from the valve body (about 10 turns). Make a note of the mounting plate orientation and remove the six screws fastening the mounting plate to the valve body with a 7/32" Allen wrench.

3. Carefully pull the entire inner valve assembly (with the cylinder assembly) out of the valve body, grasping the valve body spacer with the cylinder mounting plate (Figure 8).

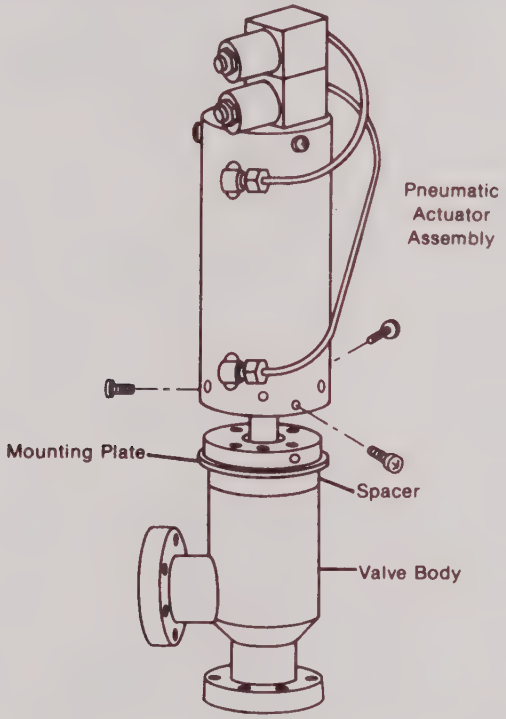

Figure 8 - Electropneumatic Assembly Removed

4. Hold the bellows laterally, gently pushing and rotating the orifice mount 1/4 turn to remove it (refer to Figure 5).

5. Set the inner valve assembly and spring aside on a clean surface.

6. Remove the top Viton seal from the orifice plate. If the orifice plate sticks to the bottom Viton seal, use a soft, blunt rod type instrument (a tightly rolled piece of paper will do) to free the plate from beneath.

NOTE:	Orifices may be reused if they are stored away from contaminants. DO NOT attempt to use an orifice which has become bent or deformed in handling, as it will not seal properly.

7. New orifice sets are shipped with both seals included. Place the bottom seal in the insert and center it before the orifice plate is installed, followed by the top seal and the washer (see Figure 7).

8. With the main spring on the plunger of the inner valve assembly, insert the retainer laterally into the orifice mount, so that the fins on the retainer clear the pins and the spring is seated on the seal. Push in the spring and rotate the mount 1/4 turn, aligning the slot in the retainer with the hole in the mount.

9. Set the valve body spacer ("O ring") in its recess and place the inner valve assembly in the valve body. Align the holes and insert the screws in the cylinder mounting plate. Tighten with the right angle Allen wrench.

10. Thread the cylinder assembly onto the rod adapter inside the valve body about 10 turns. Back off the thread to obtain the correct position for the cylinder mounting holes and its orientation.

OPERATION

Start-Up With Turbomolecular Pump

Please review the enclosed Turbovac manual before attempting to operate this system.

1. Tightly close the IPC-2 valve.

2. Turn on the air cooler or water for the turbo pump.

3. Turn on the rotary vane backing pump and push the "START" button on the turbo pump power supply. The "acceleration" light on the front panel should be illuminated.

4. After about 2 to 3 minutes the "Normal Operation" light should come on, indicating that the turbo pump is up to normal running speed. If this fails to occur it is indicative of a problem, such as:

   - Incomplete electrical cable connection. Check the connection.
   - A large air or gas leak into the system. Check tightness of flange screws where attached to the system and the flange on the top of the turbo pump Make certain the IPC-2 valve is tightly closed.
   - Poor backing system pressure. Check both pump connections.
   - Solenoid valve in the venting device assembly is stuck open or leaking.

Read Section 7, "Trouble Shooting", in the Turbovac manual for a more detailed discussion of possible problems and their analyses.

> ***CAUTION:*** *Operating the rotary vane pump without operating the turbo pump can result in exposure of the Inficon quadrupole to oil vapors, resulting in contamination and possible reduced life of the sensor.*

Gas Analysis

The IPC-2 permits gas analysis in two modes:

High Vacuum — This mode is used only when the process chamber is at high vacuum (10^{-5} torr or less). The pressure in the IPC-2 is the same as in the process chamber. It is mandatory that the turbo pumped IPC-2 systems must be in operation or the process chamber vacuum will draw vapors through the roughing system, into the turbo exhaust port, and subsequently into the process chamber.

Low Vacuum — This mode is to be used when the process chamber pressure is between 10^{-5} torr and the maximum pressure limit for the orifice in use (See Figure 8). The pressure in the IPC-2 is proportional to the process chamber pressure, but is reduced to a level suitable for a gas analyzer.

Operating conditions for the respective modes are as follows:

	Pressure Mode	
	High Vacuum	**Low Vacuum**
Full Open Position	Used	Unused
Orifice Position	Unused	Used
Turbo Pump	Used	Used

Shut Down

Before venting the process chamber, close the valve on the IPC-2. Tightening by hand will be sufficient.

Turn off the Inficon quadrupole and close the IPC-2 valve. Turn off the backing pump and press the "STOP" button on the turbo pump power supply to turn off the turbo pump.

When the power to the vent valve is turned off, the vent valve will open. Venting the system with inert gas, which floods the system and also flows into the interconnections between the turbo and backing pumps, suppresses any possible backstreaming of oil vapors from the backing pump into the turbo pump and IPC-2.

This procedure also prevents contamination of the quadrupole sensor due to exposure to air and moisture.

THEORY OF OPERATION

The IPC-2 is designed for analysis of gases at pressures which are too high for direct exposure to the Inficon quadrupole gas analyzer sensor. In this case, the IPC-2 reduces the partial pressures of each of the components in the gas mixture by a fixed proportion, prior to analysis.

The pressure reduction is accomplished by the "double-molecular-leak" method. As shown in Figure 8, gas molecules from the process chamber (vacuum system) are admitted through the control orifice (3) to the measuring volume containing the quadrupole sensor (6). Simultaneously, gas molecules are escaping from the measuring volume through the restrictor (7) to the pump (5). Under steady stated conditions, such a system produces a fixed ratio between the pressure at point (1) and the pressure at point (6). The pressure ratio is equal to the ratio of the pumping speed, controlled by the restrictor gasket (7), to the conductance of the orifice (3).

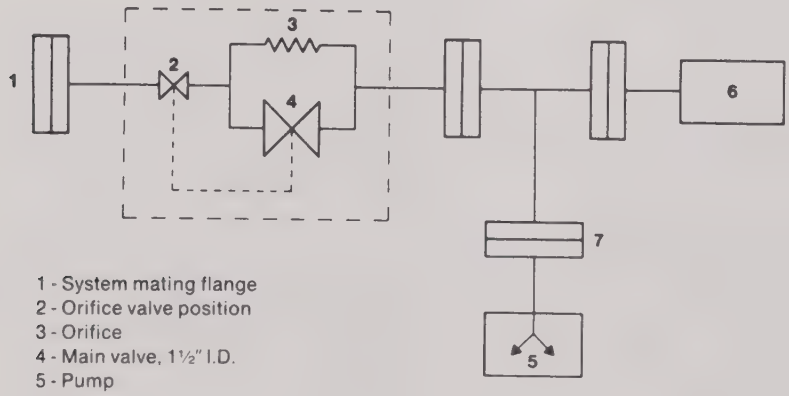

Figure 9 - Vacuum Schematic

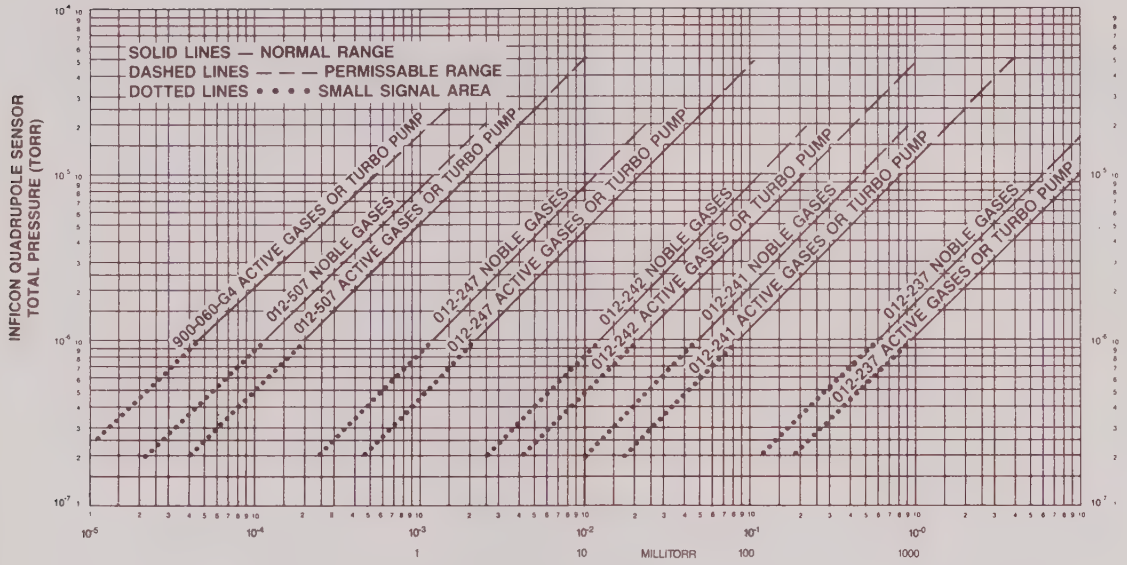
SOLID LINES — NORMAL RANGE
DASHED LINES — — — PERMISSABLE RANGE
DOTTED LINES • • • • SMALL SIGNAL AREA
INFICON QUADRUPOLE SENSOR TOTAL PRESSURE (TORR)
900-060-G4 ACTIVE GASES OR TURBO PUMP
012-507 NOBLE GASES
012-507 ACTIVE GASES OR TURBO PUMP
012-247 NOBLE GASES
012-247 ACTIVE GASES OR TURBO PUMP
012-242 NOBLE GASES
012-242 ACTIVE GASES OR TURBO PUMP
012-241 NOBLE GASES
012-241 ACTIVE GASES OR TURBO PUMP
012-237 NOBLE GASES
012-237 ACTIVE GASES OR TURBO PUMP
MILLITORR

Figure 10.1 - IPC-2 Pressure Conversion Chart with Orifice Part Numbers

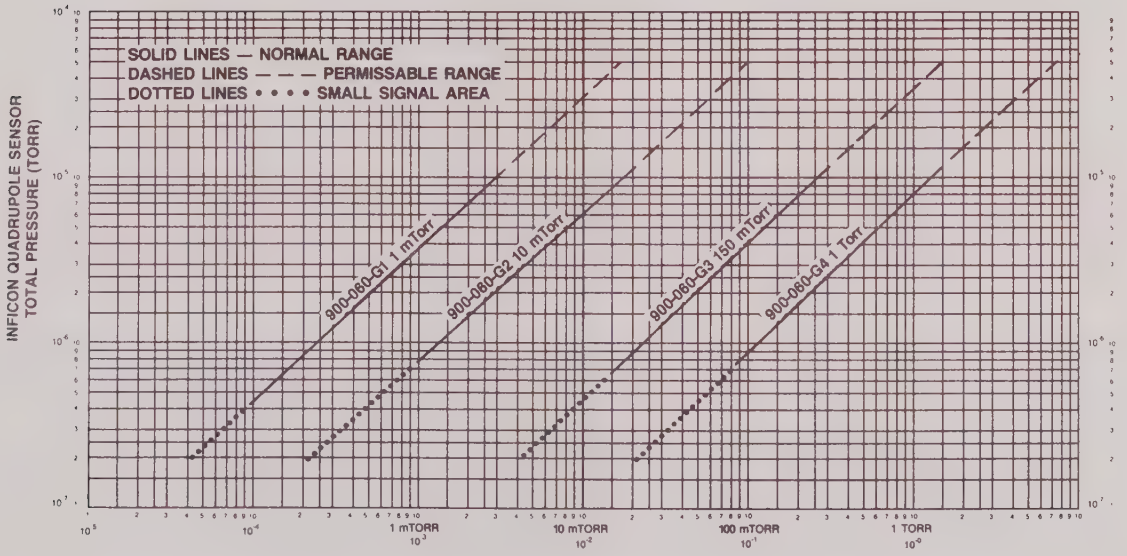

Figure 10.2 - Turbo Pumped Pressure Conversion Chart with Orifice Part Numbers

IPC-2 PRESSURE CONVERTER

The relationship between the process chamber pressure and the pressure in the measuring volume of the IPC-2 is given by the Pressure Conversion chart (Figure 9). In this chart, lines are given for several orifice sizes, (.1 millitorr, 10 millitorr, 150 millitorr, 1 torr, and 10 torr). When using a turbo pump, all gas species are pumped at the same speed.

MAINTENANCE

One item in the IPC-2 requires periodic maintenance.

NOTE:	The TMP-50 turbo pump is permanently lubricated and doesn't need to be greased. The TMP-150V turbo pump is oil lubricated and does require that oil to be changed periodically. Please refer to the TMP-150 instruction manual for details.

The level of oil in the backing pump must be checked regularly. Review the maintenance section of the backing pump operating instructions.

The following manuals are supplied with the IPC-2:

- Turbo Pump Operating Instructions and Spare Parts List
- Frequency Converter Operating Instructions and Spare Parts List
- Backing Pump Operating Instructions and Spare Parts List

HEATING JACKET INSTRUCTIONS

The heating jacket consists of three parts (Figure 11);

(1) Sensor mantle
(1) IPC-2 valve mantle
(1) "Tee" insulator

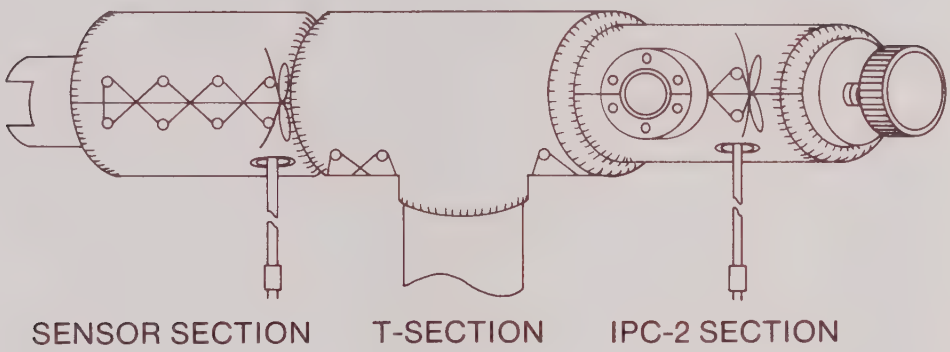

Figure 11 - Heating Jackets

Install the sensor mantle so that the mantle does not protrude over the plastic connector, nor come into contact with anything that will melt or burn when the heating jacket is in use.

> ***CAUTION:*** *DO NOT restrict ambient air from cooling the connector. Impeded air circulation may cause the connector to melt.*

WARNING!!
Metal surface can become dangerously hot!

The mantle for the IPC-2 manual valve should not protrude over the detent handle. You may choose to lift the detent handle with a screwdriver blade when the heating mantle is operating. The mantle for the IPC-2 electropneumatic version should not protrude over the cylinder.

> ***CAUTION:*** *Restricting ambient air from cooling the electropneumatic air cylinder may cause damage to the seals inside the cylinder.*

Check to make sure that the heater uniformly fits around the part it was made to heat. For proper temperature control, find the location of the thermostat and use the fiberglass lacing to firmly couple it to the metal of the part to be heated. Also use the lacing to contour the jacket around the part.

NOTE:	The first time the heating jacket is used it will "smoke". This is normal and should stop after several hours of operation.

INFICON SPARE PARTS LIST

Description	Weight	Part No.
.1 millitorr orifice (.05 to .4 mtorr) metallic foil orifice disc	1 lb.	900-060-G4
1 millitorr orifice (.3 to 5 mtorr) metallic foil orifice disc	1 lb.	012-507
10 millitorr orifice (2 to 20 mtorr) metallic foil orifice disc	1 lb.	012-247
150 millitorr orifice (20 to 200 mtorr) metallic foil orifice disc	1 lb.	012-242
1 torr (1000 mtorr) orifice (200 mtorr to 2 torr) metallic foil orifice disc	1 lb.	012-241
10 torr orifice (1 to 10 torr) metallic foil orifice disc	1 lb.	012-237
8 millitorr (maximum pressure)	1 lb.	012-248
15 millitorr (maximum pressure)	1 lb.	012-246
25 millitorr (maximum pressure)	1 lb.	012-245
35 millitorr (maximum pressure)	1 lb.	012-244
60 millitorr (maximum pressure)	1 lb.	012-243
Restrictor Gasket - special gasket used between the pump and the IPC-2 (one included with each IPC-2)	1 lb.	012-218

High Flow Option for Turbopumped IPC-2

Additional spare parts for the Turbo System are described in the Turbovac 50 Spare Parts List.

1 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	900-060-G4
10 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	900-060-G3
150 millitorr orifice (maximum pressure) metallic foil orifice disc	1 lb.	900-060-G2
1 torr orifice (maximum pressure) metallic foil orifice disc	1 lb.	900-060-G1
High Flow Restrictor Gasket - special gasket used between the pump and the IPC-2 (one included with each IPC-2)	1 lb.	900-038-P2

All orifices are replaceable and reusable. For special orifices, contact INFICON.

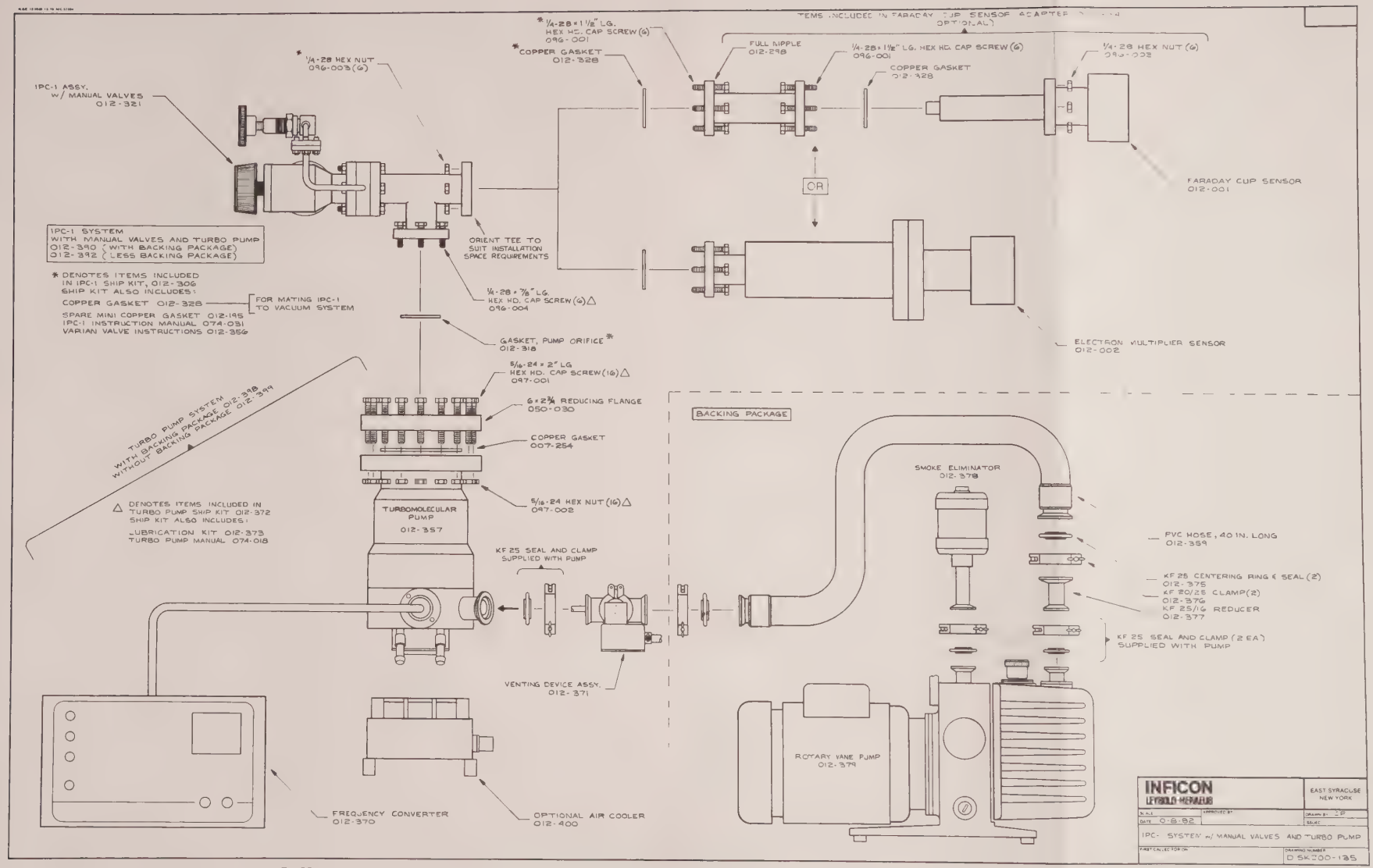
ITEMS INCLUDED IN FARADAY CUP SENSOR ADAPTER (OPTIONAL)
* 1/4-28 x 1 1/2" LG. HEX HD. CAP SCREW (6) 096-001
* COPPER GASKET 012-328
FULL NIPPLE 012-298
1/4-28 x 1 1/2" LG. HEX HD. CAP SCREW (6) 096-001
COPPER GASKET 012-328
1/4-28 HEX NUT (6) 096-003
* 1/4-28 HEX NUT 096-003 (6)
IPC-1 ASSY. w/ MANUAL VALVES 012-321
OR
FARADAY CUP SENSOR 012-001
IPC-1 SYSTEM WITH MANUAL VALVES AND TURBO PUMP
012-390 { WITH BACKING PACKAGE)
012-392 { LESS BACKING PACKAGE)
ORIENT TEE TO SUIT INSTALLATION SPACE REQUIREMENTS
* DENOTES ITEMS INCLUDED IN IPC-1 SHIP KIT, 012-306
SHIP KIT ALSO INCLUDES:
COPPER GASKET 012-328 — FOR MATING IPC-1 TO VACUUM SYSTEM
SPARE MINI COPPER GASKET 012-195
IPC-1 INSTRUCTION MANUAL 074-031
VARIAN VALVE INSTRUCTIONS 012-356
1/4-28 x 7/8" LG. HEX HD. CAP SCREW (6) △ 096-004
ELECTRON MULTIPLIER SENSOR 012-002
GASKET, PUMP ORIFICE * 012-318
5/16-24 x 2" LG HEX HD. CAP SCREW (16) △ 097-001
6 x 2 3/4 REDUCING FLANGE 050-030
COPPER GASKET 007-254
5/16-24 HEX NUT (16) △ 097-002
TURBO PUMP SYSTEM WITH BACKING PACKAGE 012-398 WITHOUT BACKING PACKAGE 012-399
△ DENOTES ITEMS INCLUDED IN TURBO PUMP SHIP KIT 012-372
SHIP KIT ALSO INCLUDES:
LUBRICATION KIT 012-373
TURBO PUMP MANUAL 074-018
TURBOMOLECULAR PUMP 012-357
KF 25 SEAL AND CLAMP SUPPLIED WITH PUMP
VENTING DEVICE ASSY. 012-371
FREQUENCY CONVERTER 012-370
OPTIONAL AIR COOLER 012-400
BACKING PACKAGE
SMOKE ELIMINATOR 012-378
PVC HOSE, 40 IN. LONG 012-359
KF 25 CENTERING RING & SEAL (2) 012-375
KF 20/25 CLAMP (2) 012-376
KF 25/16 REDUCER 012-377
KF 25 SEAL AND CLAMP (2 EA) SUPPLIED WITH PUMP
ROTARY VANE PUMP 012-379
INFICON LEYBOLD-HERAEUS
EAST SYRACUSE NEW YORK
DATE 10-8-82
IPC- SYSTEM w/ MANUAL VALVES AND TURBO PUMP
D-SK200-135

Figure 12 - IPC-2 Assembly (Exploded Drawing)

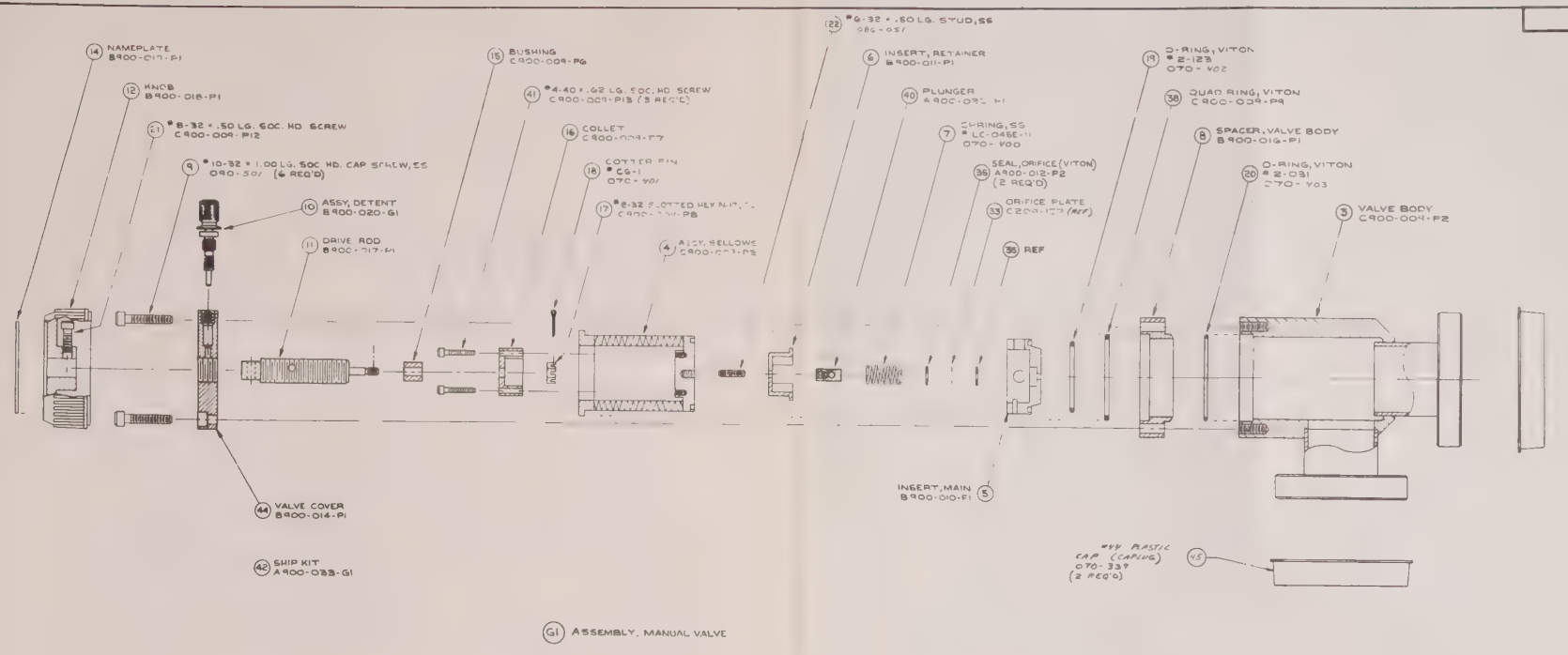
(14) NAMEPLATE B900-017-P1
(12) KNOB B900-018-P1
(21) * 8-32 x .50 LG. SOC. HD SCREW C900-009-P12
(9) * 10-32 x 1.00 LG. SOC HD. CAP SCREW, SS 090-501 (6 REQ'D)
(10) ASSY, DETENT B900-020-G1
(11) DRIVE ROD B900-017-P1
(44) VALVE COVER B900-014-P1
(42) SHIP KIT A900-033-G1
(15) BUSHING C900-009-P6
(41) * 4-40 x .62 LG. SOC. HD. SCREW C900-009-P13 (3 REQ'D)
(16) COLLET C900-009-P7
(18) COTTER PIN * CG-1 070-401
(17) * 8-32 SLOTTED HEX NUT, SS C900-009-P8
(4) ASSY, BELLOWS C900-003-P3
(22) * 6-32 x .50 LG. STUD, SS 086-051
(6) INSERT, RETAINER B900-011-P1
(40) PLUNGER A900-031-P1
(7) O-RING, SS * LC-045E-11 070-400
(35) SEAL, ORIFICE (VITON) A900-012-P2 (2 REQ'D)
(33) ORIFICE PLATE C200-127 (REF)
(36) REF
(19) O-RING, VITON * 2-123 070-402
(38) QUAD RING, VITON C900-009-P9
(8) SPACER, VALVE BODY B900-016-P1
(20) O-RING, VITON * 2-031 070-403
(3) VALVE BODY C900-009-P2
INSERT, MAIN B900-010-F1 (5)
#44 PLASTIC CAP (CAPLUG) 070-339 (2 REQ'D)
(45)
(G1) ASSEMBLY, MANUAL VALVE

Figure 12A - IPC-2 Assembly (Exploded Drawing)

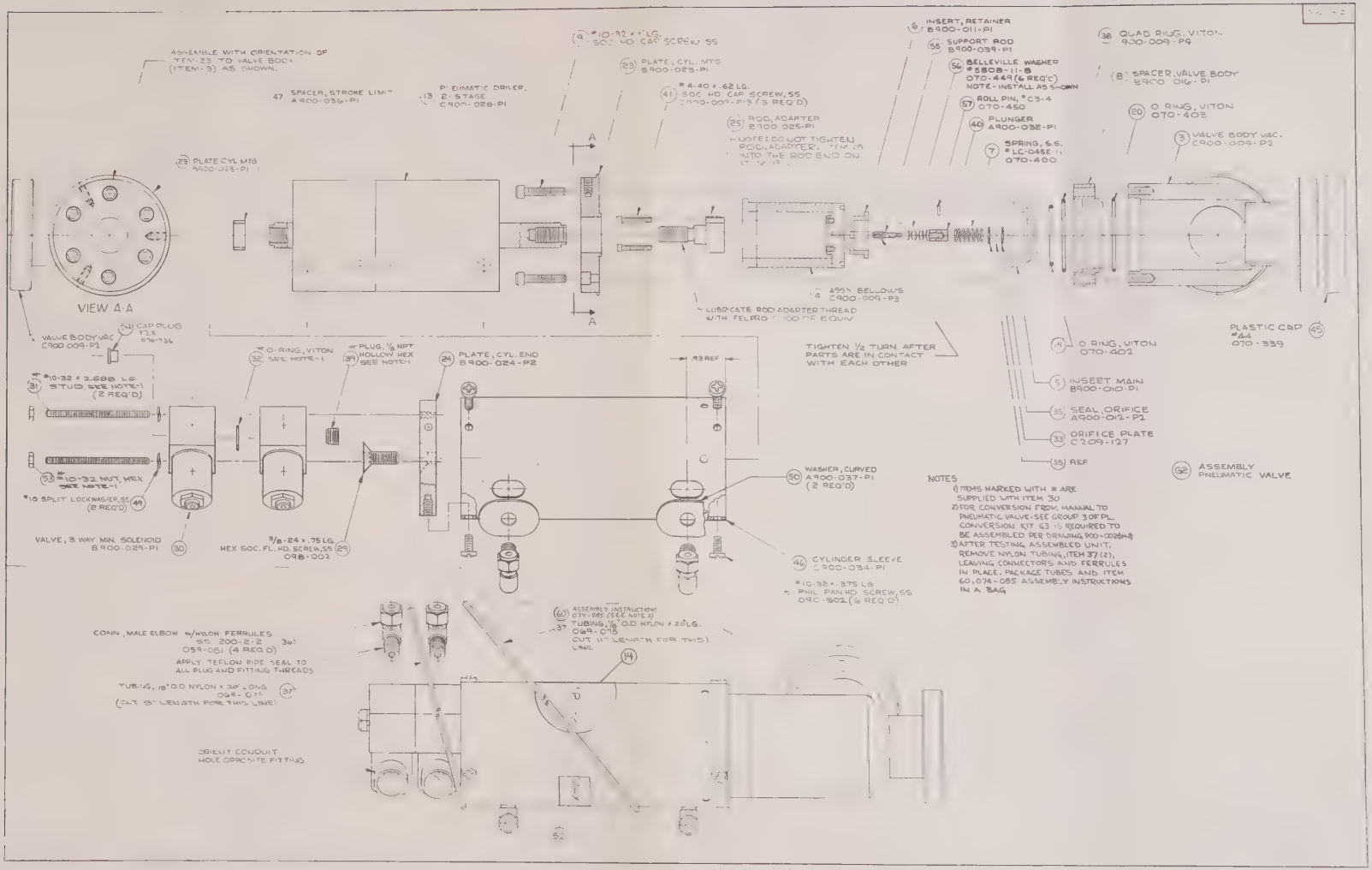
ASSEMBLE WITH ORIENTATION OF ITEM-23 TO VALVE BODY (ITEM-3) AS SHOWN.
47 SPACER, STROKE LIMIT A900-036-P1
13 PNEUMATIC DRIVER, 2-STAGE C900-028-P1
9 #10-32 x 1" LG. SOC HD CAP SCREW, SS
23 PLATE, CYL. MTG B900-023-P1
41 #4-40 x .62 LG. SOC HD CAP SCREW, SS C090-009-P13 (3 REQ'D)
25 ROD, ADAPTER B100-025-P1
NOTE: DO NOT TIGHTEN ROD ADAPTER TIM-25 INTO THE ROD END ON 17 & 19.
6 INSERT, RETAINER B900-011-P1
55 SUPPORT ROD B900-039-P1
56 BELLEVILLE WASHER #SB08-11-B 070-449 (6 REQ'D) NOTE - INSTALL AS SHOWN
57 ROLL PIN, #C3-4 070-450
40 PLUNGER A900-038-P1
7 SPRING, S.S. #LC-045E-11 070-400
38 QUAD RING, VITON 930-009-P9
8 SPACER, VALVE BODY B900-016-P1
20 O RING, VITON 070-403
3 VALVE BODY VAC. C900-009-P2
28 PLATE CYL MTG A900-023-P1
VIEW A-A
14 ASSY BELLOWS C900-009-P3
LUBRICATE ROD ADAPTER THREAD WITH FELPRO C100 OR EQUIV
TIGHTEN 1/2 TURN AFTER PARTS ARE IN CONTACT WITH EACH OTHER
42 CAP PLUG 1/4 070-436
VALVE BODY VAC C900-009-P2
32 O-RING, VITON SEE NOTE-1
39 PLUG, 1/8 NPT HOLLOW HEX SEE NOTE-1
24 PLATE, CYL. END B900-024-P2
.93 REF
31 #10-32 x 2.688 LG STUD, SEE NOTE-1 (2 REQ'D)
53 #10-32 NUT, HEX SEE NOTE-1
#10 SPLIT LOCKWASHER, SS (2 REQ'D) 49
VALVE, 3 WAY MIN. SOLENOID B900-029-P1 30
3/8-24 x .75 LG HEX SOC. FL. HD. SCREW, SS 098-002 29
50 WASHER, CURVED A900-037-P1 (2 REQ'D)
46 CYLINDER SLEEVE C900-034-P1
#10-32 x .375 LG PHIL PAN HD SCREW, SS 090-502 (6 REQ'D)
H O RING, VITON 070-402
5 INSERT MAIN B900-010-P1
35 SEAL, ORIFICE A900-012-P2
33 ORIFICE PLATE C209-127
35 REF
PLASTIC CAP #44 070-339 45
G2 ASSEMBLY PNEUMATIC VALVE
NOTES
1) ITEMS MARKED WITH # ARE SUPPLIED WITH ITEM 30
2) FOR CONVERSION FROM MANUAL TO PNEUMATIC VALVE - SEE GROUP 3 OF PL. CONVERSION KIT 63-15 REQUIRED TO BE ASSEMBLED PER DRAWING 900-028
3) AFTER TESTING ASSEMBLED UNIT, REMOVE NYLON TUBING, ITEM 37 (2), LEAVING CONNECTORS AND FERRULES IN PLACE. PACKAGE TUBES AND ITEM 60, 074-085 ASSEMBLY INSTRUCTIONS IN A BAG
60 ASSEMBLY INSTRUCTIONS 074-085 (SEE NOTE 3)
37 TUBING, 1/8" O.D NYLON x 20" LG. 099-075 CUT 11" LENGTH FOR THIS LINE
CONN, MALE ELBOW w/NYLON FERRULES SS-200-2-2 360 059-081 (4 REQ'D)
APPLY TEFLON PIPE SEAL TO ALL PLUG AND FITTING THREADS
TUBING, 1/8" O.D NYLON x 20" LONG 099-075 (CUT 8" LENGTH FOR THIS LINE)
ORIENT CONDUIT HOLE OPPOSITE FITTING
14

Figure 13 - IPC-2 System w/Manual Valve and Turbo Pump

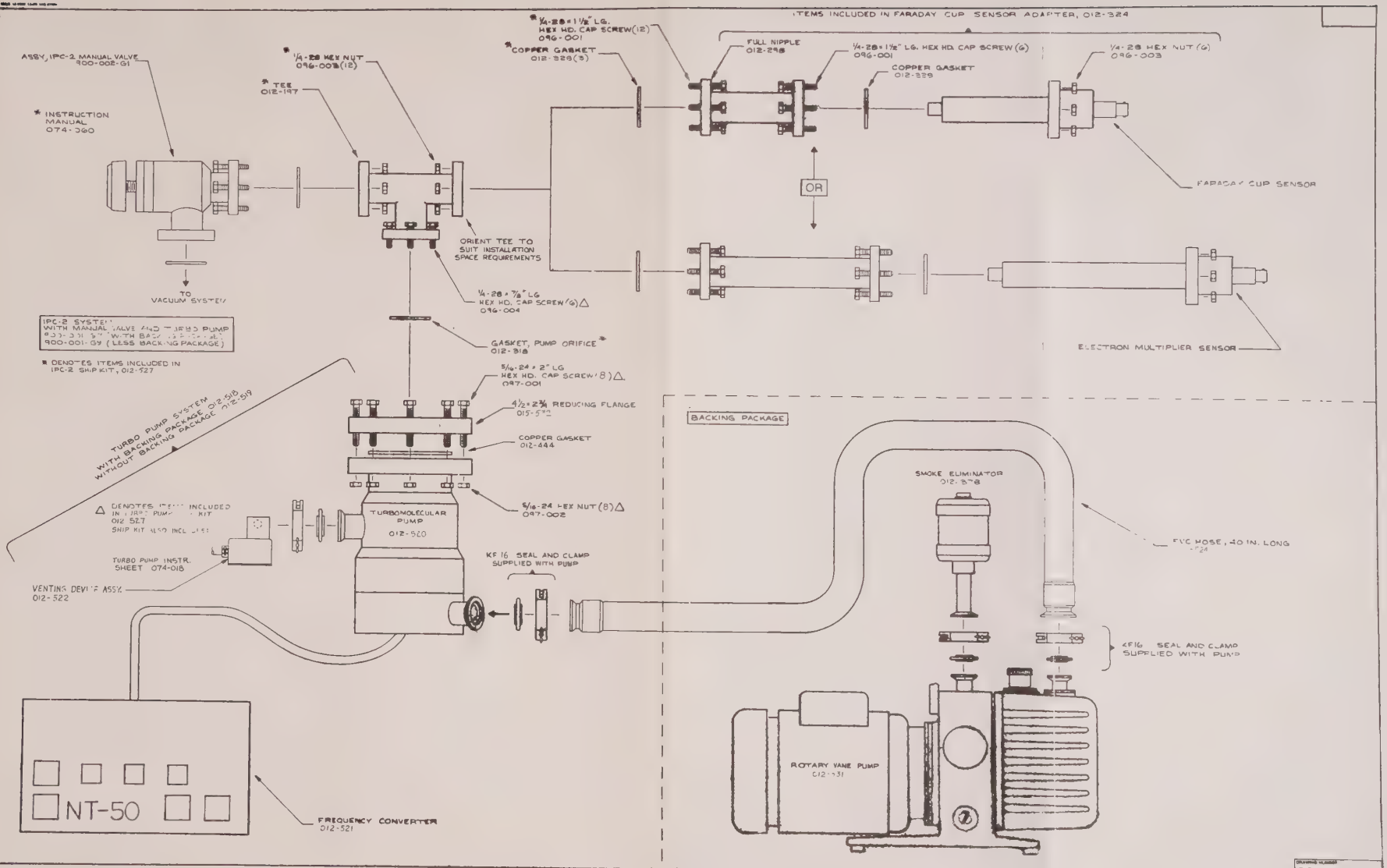
ITEMS INCLUDED IN FARADAY CUP SENSOR ADAPTER, 012-324
ASSY, IPC-2 MANUAL VALVE 900-002-G1
* INSTRUCTION MANUAL 074-060
* TEE 012-197
* 1/4-28 HEX NUT 096-003 (12)
* 1/4-28 x 1 1/2" LG. HEX HD. CAP SCREW (12) 096-001
* COPPER GASKET 012-329 (3)
FULL NIPPLE 012-298
1/4-28 x 1 1/2" LG. HEX HD. CAP SCREW (6) 096-001
COPPER GASKET 012-329
1/4-28 HEX NUT (6) 096-003
FARADAY CUP SENSOR
OR
ELECTRON MULTIPLIER SENSOR
ORIENT TEE TO SUIT INSTALLATION SPACE REQUIREMENTS
TO VACUUM SYSTEM
1/4-28 x 7/8" LG HEX HD. CAP SCREW (6) △ 096-004
IPC-2 SYSTEM WITH MANUAL VALVE AND TURBO PUMP 900-001-G1 WITH BACKING PACKAGE 900-001-G9 (LESS BACKING PACKAGE)
* DENOTES ITEMS INCLUDED IN IPC-2 SHIP KIT, 012-527
GASKET, PUMP ORIFICE * 012-318
5/16-24 x 2" LG HEX HD. CAP SCREW (8) △ 097-001
4 1/2 x 2 3/4 REDUCING FLANGE 015-5**
COPPER GASKET 012-444
TURBO PUMP SYSTEM WITH BACKING PACKAGE 012-518 WITHOUT BACKING PACKAGE 012-519
△ DENOTES ITEMS INCLUDED IN TURBO PUMP KIT 012-527 SHIP KIT ALSO INCLUDES
TURBOMOLECULAR PUMP 012-520
5/16-24 HEX NUT (8) △ 097-002
KF 16 SEAL AND CLAMP SUPPLIED WITH PUMP
TURBO PUMP INSTR. SHEET 074-018
VENTING DEVICE ASSY. 012-522
BACKING PACKAGE
SMOKE ELIMINATOR 012-378
PVC HOSE, 40 IN. LONG -724
KF16 SEAL AND CLAMP SUPPLIED WITH PUMP
ROTARY VANE PUMP 012-131
NT-50
FREQUENCY CONVERTER 012-521
DGK200-143

Figure 14 - IPC-2 System w/Manual Valve and 150 l/s Turbo Pump

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MP MASTER
MA29128